January-February
2016
Volume 64
Issue 1

# The Observer

The Newsletter of Central Valley Astronomers of Fresno

## In this Issue:



## "The Force Awakens" by the Hubble Space Telescope

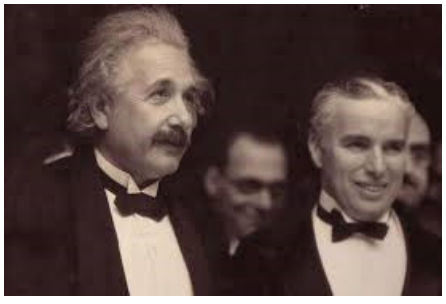
This Hubble image, released by the Space Telescope Science Institute on December 17, 2015, is reminiscent of the light sabers in the *Stars Wars* films, and is being called "The Force Awakens" by Hubble scientists. It is an object known as Herbig-Haro Jet HH24, in the Orion B nebula complex, about 1,200 light years away, and is caused by gas that is being heated to superhot temperatures and then shot out of a newborn star. This was one of many great images taken by the Hubble Space Telescope in 2015, the 25th anniversary of its mission. For more, see the inside.

Image-NASA/HST/STSI

## Astronomy Quote of the Month-

"I'm famous because everyone understands everything I do. You're famous because no one understands anything you do."

-Charlie Chaplin to Albert Einstein, 1930s



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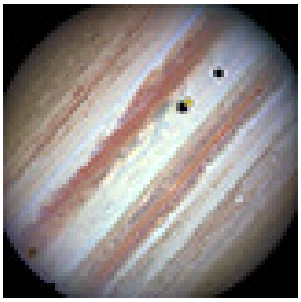
*The Observer* is the newsletter of the Central Valley Astronomers of Fresno

## Some more Great Hubble Images from 2015



Left-Jupiter, with the shadows of two of its large moon transiting its face

Right-Barred spiral NGC 1300

Left-"A Home for Old Stars"-Globular cluster Terzan 1, in the constellation Scorpius, about 20,000 light years from Earth

Right-An object known as Di Cha, a system of four(two binary) newborn stars. It is part of the Chamaeleon 1 dark cloud complex

All images-NASA/HST

# Number of extra-solar planets found as of December 2015-2,030
# How many more are out there-thousands, tens of thousands?

# Profiles in Astronomy

## Gan De(exact date of birth and death unknown, c.300 BC)

Gan De, also known as Gan Gong(Lord Gan), was a Chinese astronomer and astrologer from the State of Qi in northeastern China, who lived during what historians call The Warring States period(c. 475 BC-220 BC). He was the foremost of a whole group of astronomers and scientists who lived about the same time. He, along with another scientist, Shi Shen, compiled the first star catalogue* and also made many observations of the planets, especially Jupiter.

Little is known of Gan De's life, other that he was born and raised in Qi(some accounts, however, report him having lived in other Chinese regions), and was an astronomer and astrologer at the royal court. It is known that he and Shi worked together for a number of years, and produced several books, one of them a catalogue of 120 stars, their positions, brightness levels, and colors. Gan also made numerous observations of Jupiter, the first person to study that planet extensively. According to records, he was able to see, in an era before telescopes, the second large moon of Jupiter, Ganymede, almost 2,000 years before Galileo. For many years, scientists thought that this was impossible, but in the 1980s, observations carried out in very dark areas under certain conditions showed that the large moons of Jupiter can in fact be seen with the naked eye. As a result of these experiments, Gan has been credited as the first person to observe a moon of Jupiter.

Along with Shi, Gan also studied the other known planets, and discovered that Venus rotated opposite to them. He as well calculated the sidereal period of Jupiter, and the synodic periods of Venus and Mercury, all of which are very close to accepted figures today. In addition, he calculated the convergence cycle period of Jupiter and found it to be 400 days, only a day off modern calculations.

Gan wrote three books on his findings: *Treatise on Jupiter, Treatise on Astronomical Astrology*, and *Astronomic Star Observations*. All three have been lost and are known only through references in other texts. In 1973, a book by Gan and Shi was found among a number of other classical Chinese manuscripts discovered in Mawangdui. It is known as *Divination of the Five Planets*, and deals with the motions of Jupiter, Venus, Mercury, Mars, and Saturn. The book is believed to be a copy of the original, and is dated between 240 BC and 175 BC, over a hundred years after Gan and Shi probably lived.

*Babylonian astronomers had written star catalogues as early as 1200 BC, but they were compiled anonymously. Gan's star catalogue was the first to have a name attached to it.

Sources: "Gan De," Wikipedia ; "Gan De," Chinaculture.org

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# CVA History and Culture

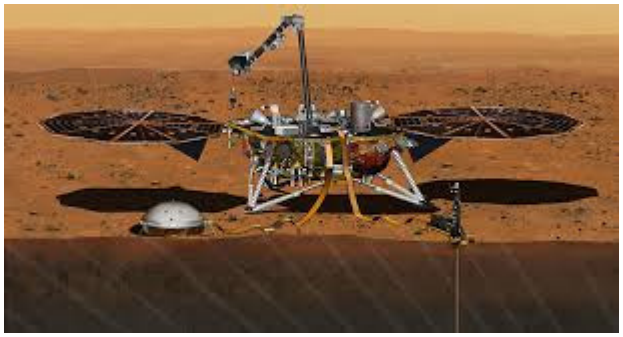

In 2015, I was fortunate to receive a number of documents relating to CVA history. First, Louis Mendoza, who has been involved in CVA for almost 40 years, gave me a box of old *Observers,* dating back to the 1980s, along with some newspaper articles and other stories pertaining to the club. Then Clarence Funk, who has been in CVA probably longer than Louis, gave me some more old *Observers,* these going back to the 1970s, along with other material and information about the club when he was president in the 1980s and early 90s. I am currently in the process of reviewing and organizing all these materials, and hope to make a major report on them to the CVA membership, via *The Observer*, within a few months. In addition, CVA's charter of incorporation, which was instituted in 1978, and the by-laws, both of which were missing for some time, have been found and will be published in a future *Observer* as well. I look forward to see what the club was like in the 1970s(seems so long ago now), what was different, and what has stayed the same over the years. It'll all be coming in an *Observer* this year.

# What's New in Space

## NASA Announces Applications for the Class of 2017-The Martian Astronauts

On November 4, NASA announced that it will begin accepting applications in December for the astronaut class of 2017, the first in four years, and the group which will possibly make the first journeys to Mars. After several years without a way to travel into space, the space agency is now gearing up for the Orion-MPCV Era, starting in 2019, which will include manned trips to the near-lunar space environment, an asteroid, and (hopefully)eventually to Mars around 2030. In addition, both Space-X's and Boeing's "Space-Taxi" spacecraft will begin manned spaceflights in 2017, for trips to ISS. With Russia quitting the International Space Station program in 2020, NASA will need many new astronauts to keep the space station at full capacity into the 2020s. Currently, there are 46 astronauts on active flight status at the Johnson Space Center in Houston, the lowest number since the termination of the Apollo program in the 1970s. When the space shuttle program ended in 2011, half the astronaut corps left, most of them realizing that they would probably never get another space mission, at least with NASA(several former NASA astronauts are now working for commercial spacecraft companies, so they may fly in space again someday), A new class of eight was announced in 2013, which is the last time that NASA has hired astronauts. Estimates are that between fifteen and twenty people will be chosen for the Class of 2017, out of an anticipated five to six thousand applications. As with previous classes, the basic requirements are the same: be at least 25 years old and an American citizen; be between 5'2" and 6'4"; be in good health and have 20/20 corrected vision; have a minimum of a bachelor's degree in the biological or physical sciences, engineering, mathematics, or medicine; and have three years of professional experience in the major area. Pilots who apply must have all of the previously mentioned requirements, along with a thousand hours flying time in at least fifteen different types of aircraft.

## 2016 Mars InSight Launch Postponed



NASA announced on December 21 that the scheduled launch of its next Mars lander, Mars InSight, a stationary lander, has been postponed until at least 2018, and maybe longer. The problem, NASA said, was due to malfunctions in the seismometer, the main experiment on the craft. InSight's main job is to measure so-called "Marsquakes," similar to earthquakes, which would give scientists unprecedented looks at the interior of the planet. It is the single most important experiment aboard the craft, and if launched unfixed, would have definitely failed once it was activated on Mars, The problem in the seismometer, which was designed and built by CNES, the French Space Agency, was detected earlier this year, and scientists felt that they had solved it. But another test conducted on December 21 revealed that the malfunction was still there, and as a result, both NASA and CNES agreed that there was no choice but to postpone the 2016 launch. Because of orbital mechanics, the next optimum time for a Mars launch would be mid-2018, and NASA is now shooting for that date.

## Space-X Booster Recovery a Success

In what space authorities are calling a milestone in space travel, on December 21, Space-X launched a Falcon 9 rocket carrying eleven mini-satellites from Cape Canaveral Air Force Station, then guided the main booster back to Earth for a pinpoint landing so it can be reused. The launch and subsequent successful recovery of the booster was a clear demonstration of what Space-X founder Elon Musk called the era of completely reusable space launch systems, which has long been the goal of space advocates.

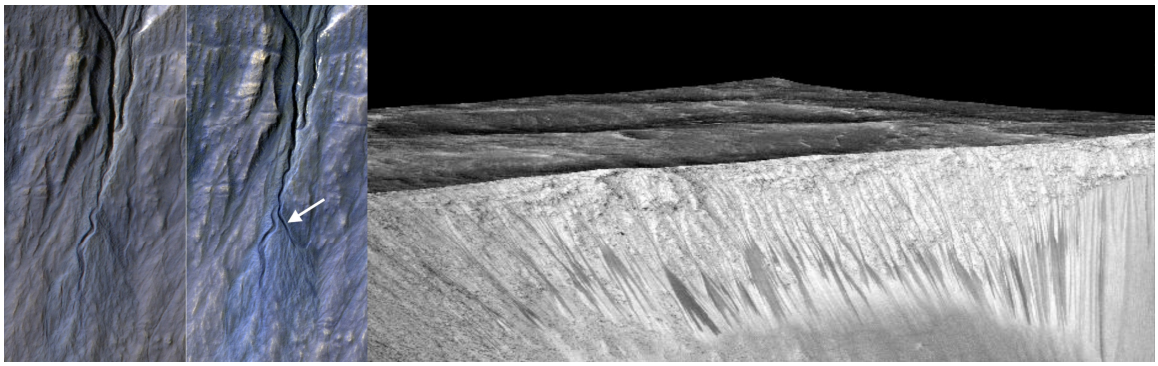
While Jeff Bezos' Blue Origin program successfully tested the New Shepherd reusable rocket in November, Space-X's system is considered far more complex and difficult to recover. The Space-X Falcon 9 success also comes in the aftermath of a failed Falcon launch in June, which destroyed a supply mission to the International Space Station. Space experts say that if rocket systems can be made truly reusable, they will exponentially drive down the costs of sending unmanned, and manned, craft, into space

## From NASA's Space Place
## How we Know Mars Has Liquid Water on its Surface
### by Ethan Siegel

Of all the planets in the solar system other than our own, Mars is the one place with the most Earth-like past. Geological features on the surface such as dried up riverbeds, sedimentary patterns, mineral spherules nicknamed "blueberries," and evidence of liquid -based erosion all tell the same story: that of a wet, watery past. But although we've found plenty of evidence for molecular water on Mars in the solid (ice) and gaseous (vapor) states, including in icecaps, clouds and subsurface ices exposed (and sublimated) by digging, that in no way meant there'd be water in its liquid phase today.

Sure, water flowed on the surface of Mars during the first billion years of the solar system, perhaps producing an ocean a mile deep, though the ocean presence is still much debated. Given that life on Earth took hold well within that time, it's conceivable that Mars was once a rich, living planet as well. But unlike Earth, Mars is small: small enough that its interior cooled and lost its protective magnetic field, enabling the sun's solar wind to strip its atmosphere away. Without a significant atmosphere, the liquid phase of water became a virtual impossibility, and Mars became the arid world we know it to be today.
But certain ions—potassium, calcium, sodium, magnesium, chloride and fluoride, among others—get left behind when the liquid water disappears, leaving a "salt" residue of mineral salts (that may include table salt, sodium chloride) on the surface. While pure liquid water may not persist at standard Martian pressures and temperatures, extremely salty, briny water can indeed stay in a liquid state for extended periods under the conditions on the Red Planet. It's more of a "sandy crust" like you'd experience on the shore when the tide goes out than the flowing waters we're used to in rivers on Earth, but it means that under the right temperature conditions, liquid water does exist on Mars today, at least in small amounts.

The measured presence and concentration of these salts, found in the dark streaks that come and go on steep crater walls, combined with our knowledge of how water behaves under certain physical and chemical conditions and the observations of changing features on the Martian surface supports the idea that this is the action of liquid water. Short of taking a sample and analyzing it in situ on Mars, this is the best current evidence we have for liquid water on our red neighbor. Next up? Finding out if there are any single-celled organisms hardy enough to survive and thrive under those conditions, possibly even native to Mars itself!



Article and image courtesy of NASA's Space Place

# The Indian Astronomical Observatory

*Part of a continuing series on lesser known-but still important-observatories throughout the world*

The Indian Astronomical Observatory, located at 14,700 feet above sea level, has the distinction of being the second highest observatory in the world. It is on Mt. Saraswati near Hanle in the Ladakh area of northwest India in Kashmir in the Himalayan foothills. It is owned and operated by the Indian Institute of Astrophysics in Bangalore.

IAO, as it is called was first proposed in the 1980s, was officially established n 1992,and the main telescope saw first light in 2000. The site was chosen for its high altitude and exceptional viewing conditions; it averages over 190 clear nights, and the altitude is excellent for one of its primary research goals of infrared astronomy. The facility also has a gamma ray telescope nearby.

The observatory currently has two operational telescopes. The main one is the 2 meter Chandra Telescope, named in honor of the Indian born Nobel physicist Subrahnmanyan Chandrasekhar. It can view objects in the visible light, infrared ,and submillimeter spectrums. The second telescope is the High Altitude Gamma Ray Telescope(HAGAR), which, as the name implies, collects information in the gamma ray part of the electromagnetic spectrum. It is actually seven telescopes, each with seven mirrors, set in a 50 meter circle, with one at the center. The HAGAR is remotely controlled from a research center some thirty miles from the facility itself.

Recently, the observatory signed an agreement with Washington University in St. Louis to build and operate a .5 meter optical telescope at IOA to study galactic nuclei. The observatory is also working with three other Indian research institutions to upgrade and enlarge the HAGAR telescope. With these improvements, the observatory plans to be one of the world's leaders in gamma ray astronomy.

Image-the 2 meter Chandra Telescope at IOA

Sources: Wikipedia, IOA website

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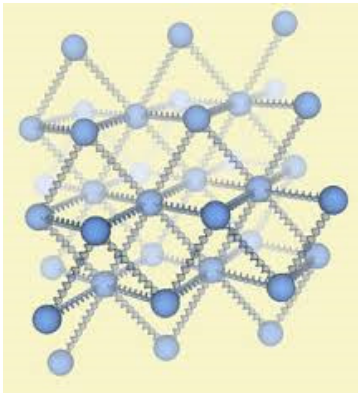
# Scientists Develop New Super-Lightweight Metal



Although not an astronomy story as such, the development of a new lightweight and exceptionally strong material will have an impact on many areas of technology and science, such as the building of lightweight and durable satellites and spacecraft. Scientists and engineers at the University of California-Los Angeles announced in the journal *Nature* on December 23 that they had developed a new metal made of ceramic silicon carbide nanocarbon particles mixed with magnesium. In order to avoid the problem of nanoparticle "clumping," the researchers used a new technique to even disperse particles throughout the magnesium mixture, resulting in a metal that is extremely light, but still very strong and highly flexible. The development, headed by Lian Yi-Chen, a post-doctoral researcher at UCLA's School of Engineering and Applied Science, shows that the new material may have applications in many different areas, including automotive technology, aerospace design, skyscraper construction, even bio-medical engineering, and represents a major breakthrough in the development of new lightweight materials.

Source-UCLA Newsroom

# Reflections on a Summer Weekend at Courtright

## By Greg Lewis

"Eyeballs in a Bag"

After a week of 103 to 106-degree temperatures we were eager to escape California's Central Valley Friday afternoon for a two-night weekend at our observing site in the Sierra Nevada mountains. The two-hour drive up and over the LeConte Divide takes us from a home elevation of about 300 feet to 8170 feet at Courtright Reservoir. There, atop a flat granite outcropping, we look east into the John Muir Wilderness and up into the darkest and clearest skies we can find within a reasonable drive.

The twisted road that is the last ten miles is a fat one-lane path on which opposing vehicles can pass if the drivers cooperate. The last several hundred yards of the trip require driving across the top of the dam which, without guard rails, is not for those who have trouble steering.

Shortly after we leveled up our truck camper and set up our scope, an SUV packed to the headliner pulled in. Tom, the driver, had come down from the Bay Area to join us and, upon opening the rear door and removing some of the camping equipment, it became apparent that there was a Very Large Telescope hiding under an old brown blanket. We discovered that it was an 18-inch Obsession, a work of art in its own right, anticipated views of the heavens notwithstanding.

As soon as it was dark enough to see a couple of stars, we abandoned our feeble instruments as the Obsession was aimed at Saturn, where the view presented us with a level of detail, contrast and clarity we had never before experienced. I was surprised to find that Saturn's light as gathered by the Obsession was almost too bright, coming close to spoiling our night vision.

While the Cassini Division is an easy mark for us even when we are set up in the valley, to be able to see the color contrasts in the rings, and the crispness with which that detail was displayed to us by this amazing instrument, was an experience we wish we could have more often.

We then moved on to other old friends, our observing lists having been abandoned as usual. Stopping at M13, the Hercules Cluster, the view of these diamonds through the Obsession made seeing them any other way almost a disappointment. Even my wife, whose attention span for astronomy is about five minutes, spent almost an hour taking her turn at the eyepiece. I felt like tossing my hopeless little scope over the cliff.

Tom popped an O-III filter behind the eyepiece and we settled in on the rubber ducky of the sky, the Swan Nebula. Although the little critter was swimming upside down in the eyepiece, the combination of the filter and the massive aperture presented us with another stunning view.We also looked at the Pinwheel Galaxy which, in an 8-inch SCT, is sort of round-ish and fuzzy, and if you think real hard about it, it could be sort of a spiraly thing. But when viewed in the Obsession, it was most certainly a pinwheel, it's arms easy to find against a deep black background. Finally, the Trifid Nebula and North American Nebula were inspected, the latter being too big for the Obsession as it was then configured.

There are simply not enough superlatives in the English language to describe the entire experience, and the views through such a telescope are so amazing that owners of these instruments should be required to provide small paper bags to all those who look through, so the observers have a place to put their eyeballs after they have fallen out of their heads.

Wanting to try the two free ortho eyepieces I had recently acquired, I staggered back to my dinky 8-incher and settled in on Saturn, hoping to see the Enke Gap, which I had been fortunate to pick out on my last trip to this site. But the skies were not willing to cooperate and, although the planet revealed a cloud band and Monsieur Cassini's empty place, Enke remained elusive.

I wasn't entirely surprised as the air aloft was active, a tropical storm about 500 miles to the south of us being predicted to affect us in a couple of days. I couldn't see that well at 194X with the 10.5 ortho, but the 16.8, at 121X, did provide nice, sharp, contrasty views of Saturn and sparkly stars with nice dark backgrounds in a couple of clusters.

Dave loaned me his OIII filter and we took a gander at the swan (pun intended), and I'm starting to think that one of those filters might be a worthwhile addition to my inventory.

Saturday morning the thermometer revealed that the overnight low had dropped to 38 degrees, a temperature we had not seen for at least five or six months. Most of the day was spent testing lawn chairs, inspecting the insides of our eyelids, and flapping gums. The daytime breeze, being strong and cool provided significant relief to the heat-weary.

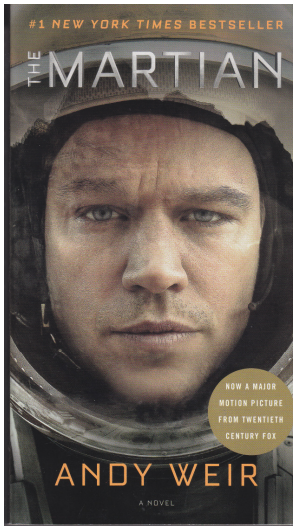
But by 4 p.m., clouds appeared. This is not unusual for the High Sierra. Afternoon sprinkles are a common summertime event and the clouds usually dissipate after sundown. But there was something about these clouds that didn't look quite the same, and we wondered if Sunday night's predicted storm was arriving early. As the clouds got darker we could still see under them miles to the south and no sky was visible. We were out of cell phone range making weather updates impossible. By 6:30 the pre-sunset darkness convinced us that this was not going to go away. With almost two hours of murky daylight remaining, there was no reason to remain atop our granite perch simply to trundle down the hill in the morning. Furthermore, to spend the night at high altitude atop an exposed rock during a thunderstorm would not be a wise thing to do. As we were packing up, thunder was heard, confirming our decision.

About half-way down the mountain we could see almost 100 miles across the valley. To the north, the setting sun was still giving hope to any costal astronomers who might be afield in their neighborhoods but to the south we saw a wall of black moving up the valley, looking like a giant angry bulldozer pushing it's way across the sky. Lightening streaked across it's leading edge providing us with a light show far better than anything the laser artists at the local arena could conjure up. Cloud-to-ground strikes punched the earth in erratic patterns, and by the time we reached the foothill villages our windshield wipers saw their first moisture in almost six months. The show continued well past midnight and we were glad we abandoned our astronomical pursuits as the morning's news reported flash flood warnings and more than two dozen lightening ignited fires. The airport's rain gauge registered just over three tenths of an inch of water.

But the one good night through the 18-inch Obsession was so good, and the show during the drive home was so spectacular, we were more than content to have lost Saturday night. We spent Sunday looking at catalog descriptions of large aperture dobsonians.

## *The Martian*-Fantasy or Reality?

By the editor




A few months ago, one of my teacher friends asked me if I had read the best seller novel *The Martian* (which I had not at the time, but have since done so), and also asked how scientifically accurate it was. It's actually a very good techno-adventure-thriller story, and many of its premises do in fact reflect current planning on how humans, when they do travel to Mars, may live on the Red Planet.

A quick summary for those who are not familiar with *The Martian*. An American astronaut is stranded on Mars due to a freak accident when he and his colleagues have to abandon their mission during a sandstorm. The rest of the book is about how he manages to survive while his crewmates and people on Earth work on ways to bring him back safely. Fortunately for the plot, he is both an engineer and a botanist, so he jury-rigs systems to communicate and produce water and oxygen, and also figures out how to grow food.(in his case, potatoes). Eventually, he has to undertake a 2,000 mile trek to another Martian base where an assent vehicle is waiting for a future mission. I won't say exactly what happens afterwards, but things do turn out happily in the end.

Now, the second question my friend asked me-is all this scientifically valid? To a great extent, yes it is. I never got beyond Algebra II, but I will assume that the orbital mechanics in the story are correct, and I know enough about manned space missions to say that the scenes aboard the spacecraft are true to life. But even more so, the technologies mentioned are not only possible, but very probable. When NASA first started seriously discussing current plans to go to Mars some twenty years ago, there was widespread agreement that the Martian astronauts would, to a certain extent, "live off the land." One of NASA's plans is that eventually Mars missions will carry with them portable "factories" for making oxygen, water, and even rocket fuel, using existing materials. Such devices have already been designed and built and are known to work under Martian-like conditions. Growing food on Mars, as well, has also been seriously discussed and tested for a number of years; space scientists envision greenhouses on the planet, which will take advantage of Mars' rich, iron-laden soil. Even the ion drive "mother" ship that the crew uses in the story is based on reality; engineers and scientists have been developing and testing ion technology for over thirty years. Several American space probes in recent years, most notably the Dawn craft to Ceres, have been powered by ion drive engines. Many in the aerospace community see ion drive space vehicles as the wave of the future; they are more efficient and less expensive in the long run than regular chemical rocket engines.

In the liner notes, the author, Andy Weir, is described as a computer software engineer and a space program enthusiast, a real techno-nerd, like many of his characters(there is a wonderful line in the story relating to that, but I can't repeat it here). He may also be a prophet. He depicts how the pioneers from Earth will survive, and maybe even thrive, on Mars in the decades to come. And as for myself, I guess that now that I've read the book, I'll have to see the movie version.